REMARKS

A Power of Attorney appointing Young & Thompson to prosecute this application is attached. Please forward all further correspondence to the indicated Young & Thompson address.

The application has been amended and is believed to be in condition for allowance.

As kindly suggested by the Official Action, the title has been amended to, i.e., to ALKALI-CATALYZED TWO-STAGE PARTIAL OXIDATION OF LOW SULFUR CONTENT SPENT PULPING LIQUOR TO RECOVER ALKALINE LIQUOR WITH PRACTICALLY ZERO ALKALI HYDROGEN CARBONATE CONTENT.

The Abstract has been amended responsive to the objection.

A substitute specification, and a marked-up copy thereof, is provided responsive to the objection. The undersigned attorney verifies that no new matter is entered by way of this amendment.

The claims have been amended responsive to the claim objections.

Claims 4, 5, 7 and 8 were rejected under section 112, first paragraph as failing to comply with the written description requirement, i.e., that applicant had possession of the invention at the time of filing the application. It appears that this is really an antecedent basis rejection in that the specification does not provide antecedent basis for all the claims' recitations.

With regard to the objections against claim 7, the discrepancy between the claims and the specification has been addressed by reintroducing the content of the claim into the specification. The sentence "The sodium borates comprise trisodium borate, disodium borate and sodium metaborate." is introduced on page 11, line 25 (with respect to the original specification), after the sentence ending "...their potassium analogues." Further, it is clarified that "disodium borate is also called tetrasodium borate". This is known to those of skill and is not considered new matter.

Regarding claim 8, the subject matter of this claim has been on page 9, line 27, after the sentence ending "...lower than 10%. "

Withdrawal of this rejection is solicited.

The previously pending claims were rejection under section 112, second paragraph as indefinite.

The claims have been amended to remedy the stated bases of rejection. New claims 13-14 are based on claim 5.

Withdrawal of this rejection is solicited.

Claims 1, 2, 3, 6, and 8-11 stand rejected as obvious over STIGSSON (WO oo/47812) in view of BACKLUND et al. 5,746,886 and further in view of KOHL 4,682,985 and NILSSON 5,868,805.

Claim 7 is rejected over these four references in further view of HUPA et al. (Fireside behavavior …").

Claim 7 is rejected over these four references in further view of RYDHOLM ("Pulping Processes").

Claim 12 is rejected over these four references in further view of NILSSON 5,976,321.

Applicant notices that his own previous application WO 00/47812 (STIGSSON) has been relied on as the main reference.

STIGSSON discloses sulfur-free cooking, rather than partial oxidation of cellulose spent liquor.

Reconsideration and withdrawal of the rejections are respectfully requested in that the references, taken individually and in combination, do not teach all the features recited by the claims.

In contrast to sulfur-free cooking, the main issue in recent black liquor gasification trials and a question of great importance concerns how to prevent carbon dioxide (formed during gasification of black liquor in all types of gasifiers) from reacting with alkaline compounds in the gas phase or from reacting with alkaline compounds in an aqueous solutions such as cooling/quenching liquids eventually forming the base for cooking liquor production (green liquor).

Low alkalinity in green liquor due to undesired reactions with carbon dioxide will negatively impact production capacity and increase causticising cost in the pulp mills.

Applicant has recognized that carbon dioxide reacts with alkaline smelt droplets and forms less alkaline carbonate compounds at temperatures below about 1000 C. This reaction is clearly undesired.

Applicant has also realized that this carbon dioxide reaction with quench liquids can be prevented by using an updraft type of gasifier wherein smelt and gas is separated at high temperature, preferably above 1000 C. In such a case carbon dioxide is not permitted to react with the alkaline compounds during cooling/quenching of the smelt and thus no bicarbonate will be formed in the aqueous solution (green liquor precursor liquor).

A core feature of the present invention, which is not disclosed or suggested in STIGSSON WO 00/47812 (or any other prior art document) is that:

all smelt and particulates formed during the partial oxidation of spent pulping liquor (black liquor), will face the very hot (1000-1400 C, preferably 1150-1300 C, see specification page 11 line 21-22) environment in the first reaction zone of the gas generator prior to separation of the liquid molten slag from the hot gaseous component stream.

Importantly, this is true regardless of which zone the spent pulping liquor (black liquor) is injected into the gas generator (gasifier).

The advantage of the inventive process is that undesired reactions between carbon dioxide and smelt/ alkaline particles entrained within the gas or particles formed in the second reaction and gas transfer zone, are reversed as the smelt/particles are conveyed by gravity from the second reaction or gas transfer zone counter current to the gaseous stream (through the very hot first reaction zone) to combine with the alkaline molten slag in the first reaction zone of the gas generator.

In case small slag particles entrained in the cooled gas after the second reaction and gas transfer zone of the gas generator represent a significant portion of the alkali fed to the gas generator, they may be recycled to the gasifier feed stream (claim 1 (e)) to be decomposed to more alkaline material and separated jointly with the alkaline molten slag beneath the hot first reaction zone of the gas generator.

The present application first teaches this process. Importantly, the process according to the invention effectively reinstates the highly alkaline property of the liquid alkaline molten material formed in any zone of the gas generator.

It is recognized that STIGSSON WO 00/47812 on page 36 line 18 to 32, describes the separation of alkaline material by gravity or by other means in a separate gas diversion and smelt separation zone arranged in or adjacent to a gas generator, such separation being effected without substantially reducing the temperature of the hot gas stream. Injection of a second increment of spent liquor into a second unfired vertical section of the gas generator is described as an example. However, cooling to below 1000 C in this zone is not specified and, more importantly, "any carryover of entrained particles or droplets! (from the second reaction zone) can be separated from the gas by quenching or scrubbing" (page 36 line 31-32). This is an important difference, as this step would lead to undesired forming of bicarbonate in the quench/scrubbing liquid.)

Gravity conveyance of particles/smelt, formed in or carried into the second reaction zone, downwards countercurrent to the hot gaseous component stream to combine with a very hot smelt from a first reaction zone, is **not** disclosed in STIGSSON WO 00/47812.

Although the Official Action has referred specifically to page 36, lines 18 to 24, the writing and clear message of this text refers to gravity separation in a zone in the gas generator without substantially reducing the temperature of the hot gas stream - in other words it clearly refers only to gravity separation of material in the first reaction zone.

Further, STIGSSON WO 00/47812 does not teach or suggest the recycle of carryover particulates/material from the second unfired zone to the gas generator feed, an essential feature of the present invention (claim 1 (e)), in particular if such carryover is representing a significant portion of the alkali formed in the gas generator.

BACKLUND et al., KOHL and NILSSON do not teach or suggest a solution preventing carbon dioxide reactions or reversing undesired carbon dioxide reactions with alkaline smelt as described in the present application.

For efficient energy recovery, it is necessary to cool the gases down to a temperature below about 250 C and a major portion of the smelt and particulates have to be removed prior to cooling or else, undesired bicarbonate will be formed during quenching. This essential feature of the present invention is not described or disclosed.

Further, none of the references cited describe the countercurrent transport of smelt/particles from second reaction zones of a gas generator, through a first very hot zone of the gas generator, nor is there any hint of recycle of carryover fumes, particulates or other material to a gasifier feed stream to preserve/restore alkalinity of carryover material in these prior art documents.

For each of these reasons, the pending claims are believed to be non-obvious.

Reconsideration and allowance of all the claims are therefore respectfully requested.

Applicant believes that the present application is in condition for allowance and an early indication of the same is respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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APPENDIX:

The Appendix includes the following item(s):

☐ - a terminal disclaimer

☐ - a 37 CFR 1.132 Declaration

☒ - a new or amended Abstract of the Disclosure

☐ - a Replacement Sheet for Figure of the drawings

☒ - a Substitute Specification and a marked-up copy of the originally-filed specification

☐ - a verified English translation of foreign priority document

☒ - Power of Attorney or Authorization of Agent